

### **1.1. What is Lean?**

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Perhaps the best way to understand the concept of lean thinking is to consider an example from everyday life. Everyone is familiar with the daily process of brushing their teeth. The steps of the process include applying water and toothpaste to a toothbrush, rubbing the brush vigorously over our teeth, spitting out the wastewater, rinsing the toothbrush, etc. The steps that directly contribute to the desired process output of clean teeth and fresh breath are those that provide value to the customer, in this case yourself. The resources expended when rubbing the brush over your teeth are surely value adds. But what about the time spent searching for the toothpaste tube in the drawer? This provides no direct value to the customer, but consumes time and energy. Perhaps you discover that you are out of toothpaste and must walk down to a basement closet where you store the inventory of unopened toothpaste tubes. This is also wasted time and motion in the brushing process.

**Lean teaches us to first be aware of and identify the most common eight types of waste present in our processes.** Lean also gives us tools to reduce or eliminate those wastes, thereby increasing the efficiency of our process. Lean is:

- A working attitude with a bias for action
- Focusing on adding value and eliminating waste
- Continuous improvement

### **1.2. History of Lean**

For centuries, manufacturing was a craftsman's job. Most fabricated items such as furniture, musical instruments, and weaponry were handmade. This caused products to be very expensive, not replicable (each piece is unique), extremely variable in terms of quality, and highly dependent on the craftsmen that produced the product. As a result, affordability and mass production were unobtainable until the industrial revolution of the 1900s.

## 1.2. History of Lean

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During the early 1900s, the automotive industry was the most innovative of the era. Automobiles were manufactured all over the world; however, only Henry Ford had the innovation to develop mass production techniques. Ford Motor Company™ was the first company to implement the assembly line concept for building his classic Model T. He used various methods that divided labor and used hundreds of unskilled employees to perform one or two repeatable tasks, such as tightening two specific screws on the assembly line. Henry Ford was able to mass-produce his Model T Ford with high production rates at an affordable cost. This approach, though cost effective, was laden with issues of its own: quality and flexibility being the biggest challenge to overcome. The famous quote by Henry Ford is, “You can have any color, as long as it’s black”.

In 1936, Toyota Group™ was established. Toyota, fascinated with Ford's mass production assembly line, appointed an engineer to study the Henry Ford mass production operations. Japan at this time (1945) was heavily involved in World War II. Many of Japan's best and most intelligent men and women were at war.

Japan was weaker than ever and had limited resources at their disposal. Money for machinery, skilled labor, labor laws, and small market sizes were variables Toyota needed to overcome. Toyota knew they had to develop a company that was extremely flexible, utilize all of their limited machinery (no downtime), only manufacture exactly what the customer ordered, eliminate excess inventory, and empower every employee to own quality of all upstream workmanship. Toyota could not afford defects or quality of workmanship issues. Thus, the Toyota Production System (TPS) and lean were born.

In 1950, the TPS model was proven to be very successful. Using the Henry Ford mass production system as a benchmark, Toyota was able to assemble a car in 16 hours, an improvement over the 31 hours of Henry Ford. Toyota's biggest achievement was in quality and inventory. Toyota's employee empowerment approach reduced defects by 65% in comparison to Ford and minimized inventory from Ford's 2 weeks to only 2 hours. Over the next 38 years, Toyota's market shares rose from around 4% in 1950 to over 35% in 1988, surpassing Ford.

## **1.2. History of Lean**

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From 1980-2000, universities and companies researched and developed many variations of the TPS to meet their own educational or business needs. This era is known as the “Lean Institute” phase and focused on implementing the TPS philosophies, tools, and methods in manufacturing industries. Companies quickly realized that these lean principles did not only apply to manufacturing, and from the year 2000 to today the “Lean Enterprise” era was established.

Today, industries such as banking, telecommunications, manufacturing, and energy implement lean tools and philosophies to foster continuous improvement and innovation, becoming industry leaders within their business sector.

## **1.3. Misconceptions about Lean Implementation**

One of the most common misconceptions and misapplications of lean is thinking that lean means simply getting rid of process steps, process time, or process labor. Lean should never eliminate needed steps in a process. Remember that lean reduces waste and adds value. Setting arbitrary goals to reduce process cycle time or process costs by a certain rate, without understanding the value dynamics of your process, can lead to the elimination of truly value added steps. Instead, we need to first comprehensively define what is waste and what is value so that we can focus on reducing the waste in the process rather than the core of what we do well, i.e. the product and process value itself.

Lean may also be inappropriately described as a tool for manufacturing processes only. While it is true that lean has its roots in manufacturing, the principles of lean apply to all processes and all industries. Lean concepts and tools can be applied to all stages of wind generation, from construction to operations, from reducing crew travel and transportation of equipment during the construction of wind turbine to ensuring that time spent searching for tools during turbine maintenance is reduced by standardization and kitting of techniques. In addition, reducing motion also eliminates the opportunity for injuries. Implementation of a strong safety culture will also promote a positive lean culture.